Shelve in Stacks S.B.T.

72-21

# An Announcement of
# Highway Safety Literature
## . . . A Bi-Monthly Abstract Journal

HSL No. 72-21 November 3, 1972 HS-011 708 – HS-011 781; HS-800 562, 570, 682-683; HS-820 177

HSL No. 72-21
November 3, 1972

**SPECIAL ANNOUNCEMENT
ON PAGE 22**

**THIS ISSUE CONTAINS**
HS-011 708 – HS-011 781
HS-800 562, 570, 682-683
HS-820 177

*U.S. Department of Transportation / National Highway Traffic Safety Administration*

[redacted]

An Announcement of

# HIGHWAY SAFETY LITERATURE

. . . A Bi-Monthly Abstract Journal

Published twice-a-month by the National Highway Traffic Safety Administration,
Research Institute, Office of Accident Investigation and Data Analysis
Washington, D.C. 20590

## INTRODUCTION

Publications such as journal articles, proceedings, and research reports announced in *Highway Safety Literature* include some of the most recent additions to the collection of the NHTSA Scientific & Technical Information Service. Subject areas covered include all phases of highway, motor vehicle, and traffic safety, especially those encompassed by the National Traffic and Motor Vehicle Safety Act of 1966 and the Highway Safety Act of 1966.

Individual issues of *HSL* are numbered according to the year and the issue number within that year; thus, 72 designates the year and 1, 2, 3, etc. the individual issues. To aid the user in locating citations by the HS-number, the cover bears the inclusive entry number for each issue.

Entries in *HSL* are arranged according to the NHTSA Subject Category List shown in the Table of Contents. The list is a two-level arrangement consisting of five major subject fields subdivided into 59 subject groups. Documents related directly to the National Highway Traffic Safety Administration (NHTSA) are announced in a separate section headed NHTSA DOCUMENTS and are numbered in five distinct series: NHTSA Accident Investigation Reports (HS-600 000 series). NHTSA Compliance Test Reports (HS-610 000 series), NHTSA Contractors Reports (HS-800 000 series), NHTSA Staff Speeches, Papers, etc. (HS-810 000 series), and NHTSA Imprints (HS-820 000 series). For NHTSA DOCUMENTS in series HS-600 000 and HS-610 000, individual full case reports are available for inspection at the National Highway Traffic Safety Administration. HS-800 000 series and HS-820 000 series are available for, purchase from NTIS or GPO (see page ii). Although announced together in a separate section, these documents are also assigned specific subject categories for machine retrieval.

A document which contains a number of separate articles is announced as a complete volume in the subject category most applicable to it as a whole. Entries for the individual articles appear in their most specific subject category.

## SAMPLE ENTRIES

| | |
|---|---|
| Subject Category Array | |
| NHTSA Accession no . | HS-800 218 Fld. 5/21; 5/9 |
| Title of document ....... | AN INVESTIGATION OF USED CAR SAFETY STANDARDS--SAFETY INDEX: FINAL REPORT. VOL. 6 - APPENDICES G-L |
| Personal author(s) ....... | by E. N. Wells; J. P. Fitzmaurice; C. E. Guilliams; S. R. Kalin; P. D. Williams |
| Corporate author ........ | Operations Research, Inc. |
| Collation | |
| Publication date .......... | 1969 150p<br>Contract FH-11-6921<br>Report no. ORI-TR-553-Vol-6; PB-190 523 |
| Abstract ...................... | Appendices G-L to this study of used car safety standards include: indenture model diagrams for classes I-IV motor trucks; degradation, wear, and failure data for motor truck classes I-IV; and safety index tables for classes I-IV motor trucks.<br>Search terms; Wear; Trucks; Failures; Used cars; Inspection standards |

**AVAILABILITY: NTIS**

**HS-004 497 Fld. 5/19**

**AUTO THEFT–THE PROBLEM AND THE CHALLENGE**

by Thomas A. Williams, Sr.

Journal citation .......... Published in *FBI Law Enforcement Bulletin* v37 n12 p15-7 (Dec 1968)

Gives figures on the extent of the auto theft problem and comments on anti-theft devices available now or in the planning stage.

Search terms: Theft; Theft protection; Stolen cars

(Note: If the date of a report or Journal article is not given, the small letters nd will appear)

[redacted]

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NOTE: Material published in Highway Safety Literature (HSL) is intended for the information and assistance of the motor vehicle and highway safety community. While brand names, equipment model names and identification, and companies may be mentioned from time to time, this data is included as an information service. Inclusion of this information in the HSL should not, under any circumstances, be construed as an endorsement or an approval of any particular product, course, or equipment by the U.S. Department of Transportation, National Highway Traffic Safety Administration.

## AVAILABILITY OF DOCUMENTS AND INSTRUCTIONS FOR ORDERING

Articles and reports whose citations and abstracts appear in HSL are acquired from many sources, such as periodicals, journals, NHTSA Contractors' reports and NHTSA staff speeches, and other reports. Those reports other than NHTSA Contractors' reports and NHTSA generated reports and speeches (see introduction) are assigned a lower consecutive accession (HS-) number.

Department of Transportation personnel may borrow copies of publications announced in HSL from the NHTSA Technical Reference Division. Non-DOT Personnel, in the Washington, D.C. area, may borrow copies of publications for a 24-hour period only. Telephone (202) 426-2768. Government personnel in the Washington, D.C. area, use government ID phone 118-62768.

The names of the journals cited in HSL appear in *italic type* preceded by the words "Published in." The journal containing the article cited may be borrowed from most research and public libraries. Non-DOT personnel outside the Washington area should contact their company or agency libraries for assistance.

(Use any of the most recent *periodical directories* for location and price of publications cited in HSL)

NHTSA Contractors' reports and other reports can usually be obtained as indicated under AVAIL ABILITY. However, there is no certainty that copies will be available for more than a limited period after a report is issued.

The more common availability sources are identified by symbols which are explained in the next column:

NTIS: National Technical Information Service, Springfield, Va. 22151. Order by accession number: HS, AD, or PB. Prepayment is required by NTIS coupon, check or money order (made payable to NTIS). GPO coupons are not acceptable. Documents are available in paper copy (PC); in full size original or reduced facsimile, and on microfiche (MF) a 4x6" negative sheet of film (reader required).

GPO: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Give corporate author, title, personal author, and report number. Prepayment is required by GPO coupon (NTIS coupons are not acceptable), check or money order (made payable to the Superintendent of Documents).

HRB: Highway Research Board, National Academy of Sciences, 2101 Constitution Ave., N. W., Washington, D. C. 20418.

NHTSA: National Highway Traffic Safety Administration, General Services Division, Washington, D.C. 20591 (Telephone (202) 426-0874), Give HS-No.

SAE: Society of Automotive Engineers, Dept. HSL, 2 Pennsylvania Plaza, New York, N.Y. 10001. Order by SAE report numbers. Prices given are list; discounts are available to SAE members and sometimes to libraries and U.S. Government Agencies. Prepayment is required; orders received without payment are subject to a $1 handling charge.

## IMPORTANT NOTICE

WHEN REQUESTING a document, to be absolutely sure you receive what you order, give the accession number (HS, PB, AD number) or report number (in cases such as an SAE document), title of report, and the personal or corporate author (whichever is cited). When requesting an HS-numbered document from NTIS, add DOT/to the prefix HS-; example HS-800 000 should be ordered as DOT/HS-800 000.

# 1/0 ACCIDENTS

## 1/1 Emergency Services

**HS-011 708 Fld. 1/1**

### THE CRITICALLY INJURED PATIENT. CONCEPT AND THE ILLINOIS STATEWIDE PLAN FOR TRAUMA CENTERS

by D. R. Boyd; B. A. Flashner

Illinois Dept. of Public Health

1971 80p 16refs
Report no. Circ-11.075

> Chapter 1 is a reprint of "The Critically Injured Patient: A Plan for the Organization of a Statewide System of Trauma Facilities," from *Illinois Medical Journal* (Mar 1971).

The basic unit of the statewide plan is the emergency room of a community hospital, and if present, its intensive care unit. It functions as the immediate provider of care. Attached to its emergency room is a specialized ambulance. Servicing many local basic units is the area-wide trauma center. This is a hospital with a house staff, teaching programs, specialized treatment units, and many specialty services not available at the local level. Finally, there will be a small number of university-based regional trauma centers for the care of patients whose condition warrants intensive diagnosis and therapy. One of the centers will act as the coordinator and administrator of the proposed state program.

> Search terms: Illinois; Hospital emergency rooms; Ambulances; Helicopter ambulances; Emergency medical services; Transportation of injured; Injury severity; State planning; Fatality prevention; Epidemiology; Rehabilitation; Medical treatment; Accident hospitals; Data acquisition; Accident survivability; Resuscitation; Diagnosis

## 1/2 Injuries

**HS-011 709 Fld. 1/2**

### MECHANISMS OF INJURY IN AUTOMOBILE CRASHES

by D. F. Huelke

Published in *California Medicine* v116 n2 p23-9 (Feb 1972)

15refs

Data were gathered from a ten-year study of collisions that caused injury to the occupants of the cars. Injuries caused by ejection, steering assembly impacts, windshield impacts, instrument panel impacts, and rear end collisions are briefly discussed. In a comparison of injuries in the newer model automobiles–vehicles equipped with the safety features–with those in older model cars not equipped with the present-day occupant protection devices, significant reduction in injury severity was noted.

> Search terms: Ejection caused injuries; Door system failures; Windshield caused injuries; Steering wheel caused injuries; Energy absorbing steering columns; Laminated glass; Instrument panel caused injuries; Instrument panel padding; Rear end collisions; Neck injuries; Head restraints; Seat belt effectiveness; Shoulder harnesses; Injury prevention; Safety device effectiveness; Occupant protection; Injury severity; Automobile safety characteristics; Injuries by vehicle age

**HS-011 710 Fld. 1/2**

### ACCIDENT AND SUICIDE: AN ONGOING STUDY OF COMPARABLE HOSPITALIZED GROUPS OF DRIVERS INJURED IN ONE-CAR ACCIDENTS AND SURVIVORS OF SERIOUS SUICIDE ATTEMPTS

by J. Gussen

Published in *Accident Analysis and Prevention* v3 p269-76 (1971)

7refs
Grant MH-155-10

The basic general hypothesis of the study is that accident victims as a group are more like a comparable suicide group than a control group of appendectomy patients, on a number of characteristics chosen to test 14 additional, more detailed hypotheses. Surviving drivers injured in automobile accidents were compared with survivors of serious suicide attempts. Similarities noted were patterns of drinking and drug abuse, manifestation of depressive symptoms, and other psychological factors.

> Search terms: Single vehicle accidents; Lone driver accidents; Suicide attempts; Mental disorders; Alcoholism; Drug addiction; Accident survivors; Accident proneness; Driver personality; Interviews; Questionnaires; Psychological factors; Depression

## 1/3 Investigation

**HS-011 711 Fld. 1/3**

### UNIFORM ROAD TRAFFIC ACCIDENT REPORTING PROCEDURES

by C. J. Watkins

Published in *Australian Road Research* v4 n7 p67-91 (Nov 1971)

8refs

Accident investigators have recognized that the present road traffic data available in Australia is non-uniform and, therefore, of limited usefulness. Development of a standard set of definitions of accident data items and a uniform accident report form should be the first stage of unification. Over and above the information gathered at the accident

## 1/3 Investigation (Cont'd.)

### HS-011 711 (Cont'd.)

scene there is a considerable amount of off-scene information available from licensing authorities, vehicle registration offices, vehicle inspection agencies traffic courts, hospitals, insurance companies, ambulance services, and medical/coroner reports, plus detailed information on the road environment from the State Road Authorities' files. A system based on the collection of basic routine data from all these sources and collation of the data by a central data authority has been proposed. Appendices A-D show various types of traffic accident report forms.

Search terms: Accident reports; Accident report forms; Accident statistics; Australia; Data acquisition

### HS-011 712 Fld. 1/3

#### A DISCUSSION OF ANTI-COLLISION POLICY OPTIONS

by P. N. Troy

Published in *Australian Road Research* v4 n7 p53-66 (Nov 1971)

1ref

This discussion attempts to provide a framework for the consideration of anti-collision policy options. It suggests that all measures whether they relate to the roads, vehicles, or drivers can be seen as measures to eliminate collisions, to reduce their severity, or to substitute low cost for high cost collisions. The discussion attempts to draw together the various themes running through the literature on collision prevention research.

Search terms: Vehicle safety; Restraint systems; Energy absorbing bumpers; Accident causes; Australia; Accident costs; Driving tasks; Accident prevention; Driver vehicle road interfaces; Accident severity; Traffic management; Injury severity; Safety design

### HS-011 713 Fld. 1/3; 1/4

#### THE NEED FOR REPORTING "NON-INVOLVED" VEHICLES AND "DRIVER INTENT" IN ACCIDENT DATA

by D. Plummer

Published in *Traffic Digest and Review* v20 n3 p2-9 (Mar 1972)

2refs

Traffic engineers use accident reports to study physical locations which have been identified as hazardous to see if a pattern of accidents exists. They need complete reporting on the direction of travel, time of day, day of week, unusual pavement conditions, driver intent, and uninvolved vehicles. Most accident reporting forms do not include the last two elements–driver intent and uninvolved vehicles. Without full reporting of these two elements, engineering analysis can be inaccurate and misleading. Collision and condition diagrams are also necessary aids to the engineer.

Search terms: Accident analysis; Accident reports; Accident report forms, Accident location; Accident investigation; Time of accidents; Highway accident potential; Road conditions; Time of day; Noninvolved vehicles; Driving conditions, Driver behavior; Accident scale drawings; Day of week; Precrash phase; Traffic engineering

## 1/5 Statistical data

### HS-011 714 Fld. 1/5; 1/1

#### TRAFFIC ACCIDENTS WITH PERSONAL INJURY DURING EMERGENCY DRIVING

by P. Gad

Published in *Danish Medical Bulletin* v18 n3 p57-61 (1971)

4refs

This study documents the frequency of traffic accidents during emergency driving and compares it with that of ordinary driving. A review of the accident files of the Falck Rescue Company, Copenhagen, covering 61% of all emergency service in cities and rural districts of Denmark during the years 1964-66, revealed 41 cases of traffic accidents with personal injury. The mileage of emergency driving was estimated and the frequency of accidents appeared to be 5.3 per million km, while for ordinary driving it was only 0.64 per million km; this gives a ratio of 8:1. For the transportation of persons the calculated difference, which is considered smaller than the real difference, can be expressed as a 12:1 ratio, emergency compared with ordinary driving.

Search terms: Denmark; Ambulances; Emergency vehicle accidents; Accident rates; Injury rates; Injury severity; Vehicle mileage; Accident studies; Accident statistics

### HS-011 715 Fld. 1/5; 1/2

#### THE RELATION BETWEEN INJURY FREQUENCY AND SEVERITY AND VEHICLE AGE IN PRE-1967 AUTOMOBILES

by H. C. Joksch

Published in *Accident Analysis and Prevention* v3 n4 p281-9 (1971)

9refs

A hypothesis on the relation between driver injury risk and age of vehicle is suggested. Further studies of this problem will have to distinguish between a pure age effect in pre-1967 vehicles, which was found to be quite stable, and the effects of major safety improvements made beginning with the 1967 model year. To evaluate these effects properly the pure age effect must be eliminated, which can be done only on the basis of older data.

Search terms: Fatalities; Injury severity; Accidents by vehicle age; Injuries by vehicle age; Mathematical analysis; Vehicle age; Correlation analysis; Injury risks; Accident severity; Safety device effectiveness

**HS-011 716 Fld. 1/5; 1/3; 2/9**

### EFFECT OF TEMPORARY SPEED LIMITS ON ROAD ACCIDENTS

by O. Wahlgren

Published in *Traffic Engineering and Control* v13 n1 p384-7 (Jan 1972)

In April 1968, the Finnish Ministry of Transport and Public Works set up a committee to investigate the effects of the nationwide temporary speed limits of 1968 on traffic accidents. The speed limits were: 90 km/h during Easter, All Saints-Day, and Christmas; and 110 km/h during Whitsuntide, Midsummer, and at the turn of August-September. The survey was divided into speed measurements, investigation of traffic volumes, police control and weather information, collection of accident data, and the actual analysis of the results. The results of the survey show that the highest permissible speed of 90 km/h was exceeded during the speed limit period by 5.8% of passenger cars. The 110 km/h limit was exceeded by 1.7% of private cars. No effects of the temporary speed limits on accidents could be noticed. The report recommends that such speed limits be abandoned.

Search terms: Finland; Speed limit effectiveness; Correlation analysis, Regression analysis; Accident severity; Environmental factors; Overtaking; Accident statistics; Holidays, Police traffic services; Traffic volume; Speed differential; Accident studies, Speed patterns, Accident rates; Injury rates

## 2/0 HIGHWAY SAFETY

### 2/4 Design and Construction

**HS-011 717 Fld. 2/4**

### THE INEVITABLE COMPROMISE—HIGHWAYS VS. THE ENVIRONMENT

by E. G. Plowman; E. A. Imhoff

Published in *Traffic Quarterly* v26 n2 p177-88 (Apr 1972)

8refs

This presentation concerns the classic conflict between the ecologists and the road builders. The need is to develop highway department engineers who can assemble the environmental facts, interpret the findings of the ecological and other environmental scientists, and use these facts as part of the entire system of factors to achieve as their final decision a necessary and inevitable compromise. Hence, engineering education must become much more environment-oriented in colleges and universities, so that future highway department engineers will be adequately qualified.

Search terms: Highway planning; Highway location; Ecology; Highway engineering; Environmental planning; Freeway planning; Highway environmental impact

### 2/7 Meteorological Conditions

**HS-011 718 Fld. 2/7**

### AND NOW A WORD FROM THE REGULATEE!

by R. K. Hillquist

General Motors Corp.

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p366-9

9refs
Report no. SAE-720657

Regulation of noise from motor vehicles is inevitable. To provide optimum benefit to the community at a minimum of additional cost to its citizens, these regulations must recognize the responsibilities of all parties involved, provide uniform requirements as appropriate to the level of government, and embody a flexibility to adapt to new findings and circumstances. Both manufacturer and operator, as regulatees, must be considered in the drafting of vehicle noise restrictions.

Search terms: Noise control; Federal control; Community support; Local government; Corporate responsibility

**HS-011 719 Fld. 2/7**

### MOTOR VEHICLE RESTRAINTS FOR CLEAN AIR—SOME IMPLICATIONS FOR AIR POLLUTION CONTROL POLICY

by R. Witherspoon

Institute of Public Administration

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p334-9

6refs
Report no. SAE-720648

The use of restraints on motor vehicle usage to promote clean air requires decisions hampered by complex existing conditions, value conflicts, uncertain future situations, and fragmented policy-making processes. Additional knowledge through research and experimentation is required to determine the best course of action. Measures much greater in scale and severity than those currently contemplated will probably be required. This implies large scale practical and political problems and probably profound changes in city form and function.

## 2/7 Meteorological Conditions (Cont'd.)

**HS-011 719 (Cont'd.)**

Search terms: Automobile urban usage; Air pollution control; Parking prohibitions; Vehicle air pollution; Forecasting; Local government

**HS-011 720 Fld. 2/7; 4/1**

### CALIFORNIA LAWS AND REGULATIONS RELATING TO MOTOR VEHICLE NOISE

by A. S. Cooper

California Dept. of Hwy. Patrol

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P44), New York, 1972 p362-5

Report no. SAE-720655

Reasonable and effective laws for the enforcement of motor vehicle noise control have been enacted and successfully applied in California. Specific laws to prohibit both the sale and the operation of noisy vehicles were necessary. Measurements both by instruments and by human ear are practical and necessary at this time. Future controls on noise producing components, as well as the complete vehicle, appear to be necessary to obtain desirable minimum noise levels.

Search terms: California; Noise control; Noise standards; Vehicle noise; Acoustic measurement, State laws

**HS-011 721 Fld. 2/7; 5/20**

### THE TRUCK NOISE PROBLEM, AND WHAT MIGHT BE DONE ABOUT IT

by R. F. Ringham

International Harvester Co.

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p154-7

Report no. SAE-720624

It is clear that truck noise is a public nuisance. Formerly, many heavy duty trucks did not have mufflers, and early noise control efforts achieved clear improvements by adding them. Further improvement requires treatment of many sources significant to the overall noise level. It is felt that today's 88dBA level for heavy trucks can be reduced to 86 dBA by 1975, and 84 dBA by 1978, with considerable work.

Search terms: Noise control; Trucks; Noise sources; Mufflers; Acoustic measurement; Vehicle noise

**HS-011 722 Fld. 2/7; 5/20**

### ORIGINS OF DIESEL TRUCK NOISE AND ITS CONTROL

by P. E. Waters; T. Priede

Southampton Univ. (England)

Published in HS-011 740. *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p256-72

20refs
Report no. SAE-720636

The fundamental origins of truck noise are discussed and the rate at which the noise of each individual source increases with speed is shown. Various means of controlling noise from each component are considered. A method of predicting engine noise from basic engine speed and piston diameter data is given and the significance of this information to the engine designer is emphasized.

Search terms: Noise control; Trucks; Noise sources; Engine noise; Diesel engines; Speed; Engine speeds; Engine design; Engine operating conditions; Tire noise; Engine size

**HS-011 723 Fld. 2/7; 5/20; 3/8**

### THE MANY-WHEELED NOISE MONSTERS MUST BE TAMED!

by T. Berland

Citizens Against Noise

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p148-53

15refs
Report no. SAE-720623

Trucks are the major source of noise on our streets and highways, affecting the sleep and sanity of millions of city and suburban residents. Truck noise sources are many, but mainly are engine and tires. Since the automotive and trucking industries have not voluntarily quieted truck noise, the federal government must set up uniform national standards to legally require noise control. European and Canadian noise studies are noted.

Search terms: Vehicle noise; Noise control; Federal role; Noise sources; Trucks; Noise exposure; Noise tolerances, Tire noise, Sleep deprivation; International factors; Engine noise

## 2/9 Traffic Control

**HS-011 724 Fld. 2/9**

### TRAFFIC CENSUS RESULTS FOR 1970

by J. B. Dunn

Road Res. Lab. (England)

1972 26p 2refs
Report no. RRL-LR-428

This report gives estimates of the volume of traffic in Great Britain in 1970, together with figures for earlier years. The figures are based on manual censuses at over 1,000 points giving levels for 1960 and 1966; estimates for the other years have been obtained by applying trends from regular censuses at 50 points from 1956 to 1965 and at about 200 points from 1966. More detailed results are given of the continuous automatic census at 50 points on trunk, principal, and other roads, excluding former unclassified roads, which has been in progress since January 1956. The increase of motor traffic between 1969 and 1970 was 5 1/2% which was near the average rate for recent years. In 1970 travel on motorways represented 4 1/2% of travel on all roads.

Search terms: Great Britain; Traffic data analysis; Travel; Travel by type of vehicle; Vehicle mileage; Highway usage, Traffic volume; Weather; Traffic surveys; Traffic estimates; Highway characteristics

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**HS-011 725 Fld. 2/9; 2/7**

## VARIABLE MESSAGE FOG HAZARD WARNING SIGNS TO CONTROL VEHICLE OPERATING CHARACTERISTICS. INTERIM REPORT

Oregon Dept. of Transp.

1972 29p 2refs
Report no. HPR-1(6)

Prepared in cooperation with the Federal Hwy. Administration.

This project is aimed at determining the effectiveness of variable message signs in controlling traffic on an interstate highway during periods of hazardous driving conditions such as fog, vehicle accidents, or congestion. The effectiveness of the signs is being measured quantitatively by use of accident records, vehicular speeds, and headways. Insufficient data preclude drawing quantitative conclusions; however, based on data available, interviews with the state police, and visual observation of vehicular operations, it appears that the signs are effective in controlling traffic operations and thereby preventing accidents during periods of reduced visibility due to fog.

Search terms: Changeable message signs; Fog warning systems; Fog; Reduced visibility; Accident prevention; Traffic control; Environmental factors; Police traffic services; Speed limits; Sign location; Accident rates; Remote controlled signs; Sign design; Sign effectiveness; Accident location; Headways; Traffic volume; Speed; Traffic flow; Electronic monitoring systems; Digital computers; Oregon

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**HS-011 726 Fld. 2/9; 3/4**

## INFLUENCE OF SPEED LIMITS ON DRIVING BEHAVIOUR IN AUSTRIA

by S. K. Bhalla; B. Biehl; U. Seydel

Published in *Accident Analysis and Prevention* v3 n4 p257-60 (1971)

10refs

In the present study the speed behavior of two groups of drivers was studied simultaneously on the same highway, thus eliminating the influence of extraneous factors. Two speed limits were chosen, i.e. 80 km/hr and 100 km/hr. On the basis of a pilot survey of speeds on this highway it was found that a speed of less than 80 km was too low while speed of 100 km would not be advisable in the interest of safety. Speed was definitely reduced under the two speed limits whereas control groups continued to drive at about the same speed. However, reduction in speed was independent of the speed limit imposed particularly in the case of lower speed limit. The higher speed limit brought about greater reduction in speed so as to approximate closely to the speed limit imposed. No conclusive evidence was available to show greater influence of speed limits in favor of either day or night driving. However, initial speed was observed to be invariably higher during day time.

Search terms: Speed limits; Speed limit effectiveness; Speed patterns; Speed studies; Spot speed characteristics; Austria; Driver behavior; Speed recorders; Day vs night speeds; Speed signs; Speed differential

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**HS-011 727 Fld. 2/9; 4/5**

## A STUDY OF THE REAL-TIME CONTROL OF A COMPUTER DRIVEN VEHICLE

by R. A. Schmidt, Jr.

Stanford Univ.

1971 173p 8refs
Contract SD-183
Report no. AIM-149; CS-71-231; AD-732 644

Supported by the Advanced Research Projects Agency. Doctoral dissertation.

Vehicle control by the computer analysis of visual images is investigated. The areas of guidance, navigation, and incident avoidance are considered. A television camera is used as the prime source of visual image data. In the guidance system developed for an experimental vehicle, visual data are used to gain information about the vehicle system dynamics, as well as to guide the vehicle. This information is used in real time to improve performance of the non-linear, time-varying vehicle system. A scheme for navigation by pilotage through the recognition of two dimensional scenes is developed. A method is proposed to link this to a computer-modelled map in order to make journeys. Various difficulties in avoiding anamolous incidents in the automatic control of automobiles are discussed, together with suggestions for the application of this study to remote exploration vehicles or industrial automation.

## 2/9 Traffic Control (Cont'd.)

### HS-011 727 (Cont'd.)

Search terms: Experimental vehicles; Guidance systems; Automatic automobiles; Remote controlled automobiles; Real time operations; Accident avoidance; Automatic steering control; Display systems; Vehicle dynamics; Control equipment; Automatic control; Computer programs; Electronic devices in vehicles; Vehicle guidance; Vehicle control; Pattern recognition; Algorithms; Sensors; Motion sensors; Closed circuit television; Flow charts

**AVAILABILITY: NTIS**

### HS-011 728 Fld. 2/9; 4/7

### SPEED/FLOW RELATIONSHIPS ON SUBURBAN MAIN ROADS

Freeman Fox and Associates (England)

1972 29p 1ref

Sponsored by Road Res. Lab. (England).

The relationship between journey speed and flow has been investigated at several sites on main roads in suburban areas. The differences observed in the resulting speed/flow relationships have been attributed to differences in the physical conditions prevailing at the sites, the most important being the number of intersections, the proportion of dual carriageway, the amount of access available to the adjacent land uses, and the amount of development on the adjacent land. The analysis described enables predictions to be made of speed/flow relationships on suburban main roads, given a knowledge of these physical conditions.

Search terms: Travel time; Traffic flow; Speed patterns; Suburban roads; Speed volume relationships; Traffic density; Traffic counts; Traffic volume; Road width; Intersections; Speed limits; Peak hour traffic; Highway location; Land usage; Off peak hours; Great Britain; Environmental factors; Linear regression analysis; Regression analysis; Vehicle weight; Highway characteristics

## 3/0 HUMAN FACTORS

## 3/1 Alcohol

### HS-011 729 Fld. 3/1

### IDENTIFYING A MAJOR HAZARD ON THE HIGHWAYS—THE PROBLEM DRINKING DRIVER

by R. G. Mortimer; M. W. Kerlan; L. D. Filkins; J. S. Lower

Published in *Police* v16 n8 p17-24 (Apr 1972)

33refs

Studies are reviewed showing that drinking drivers are over-involved in traffic accidents. Excessive drinkers constitute a large subgroup of these drinking drivers. The development of a questionnaire and an interview is described by means of which the problem drinker, convicted of a drinking-driving offense, can be identified for legal and medical treatment purposes. Other countermeasures are described which may be able to restrict the use of a vehicle by the driver when he is impaired. Statistical data show that the exposure of drinking drivers is greatest in the early morning hours, particularly on weekends, on medium volume roads, and that there are more than two and one half times as many drivers between 0.10% and 0.15% BAC as above 0.15%. The implications of these findings for law enforcement and a health-legal approach to reducing alcohol-involved crashes are discussed.

Search terms: Drinking drivers; Alcoholism; Driver rehabilitation; Blood alcohol levels; Time of day; Day of week; Driver interviews; Accident location; Traffic law enforcement; Questionnaires; Problem drivers; Alcohol usage deterrents; Driver identification; Driver intoxication

### HS-011 730 Fld. 3/1

### TATTOOS, ALCOHOL, AND VIOLENT DEATH

by S. P. Baker; L. S. Robertson; W. U. Spitz

Published in *Forensic Sciences Journal* v16 n2 p219-25 (Apr 1971)

16refs

Tattooed drivers fatally injured in crashes and tattooed homicide victims were more likely than their nontattooed counterparts to have contributed to the events leading to their deaths. Alcohol was correlated with presence of tattoos among drivers, and was a major factor in both forms of violent death. The study was based on recrods of 227 white male driver fatalities and 140 white male homicide victims in Baltimore.

Search terms: Tattoos; Drinking drivers; Driver fatalities; Correlation analysis; Homicide; Male drivers; Accident responsibility; Blood alcohol levels; Driver personality; Baltimore; Psychological factors

### HS-011 731 Fld. 3/1; 5/4

### WILL CARS SAY NO TO DRINKING DRIVERS

by J. Kielty

Published in *Traffic Safety* v72 n4 p10-3, 39 (Apr 1972)

Alcohol, consumed by both social and abusive drinkers, is a factor in at least 25,000 traffic deaths in the United States each year. A workable solution must be found. In addition to educating the public about the dangers of drinking and driving and calling for more stringent enforcement procedures, the possibilities of an engineering solution, alcohol safety interlock systems, are discussed. Special license plates are also discussed.

Search terms: Alcohol detection and interlock systems; Alcohol usage deterrents; Special license plates; Alcoholism; Social drinking; Driver physiological test devices; Blood alcohol levels; Traffic law enforcement; Alcohol education; Drinking drivers; Driver intoxication; Alcohol Safety Action Projects

## 3/8 Environmental Effects

**HS-011 732 Fld. 3/8**

### ARE PRESENT HORNS, WHISTLES AND SIRENS NECESSARY FOR COMMUNICATIONS?

by K. M. Eldred; B. H. Sharp

Wyle Labs.

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p277-85

10refs
Report no. SAE-720640

Audible warning systems used on emergency vehicles and trains are of major concern to the community. The various types of existing audible warning systems and their historical development are discussed, as well as their effectiveness in warning people of imminent danger. It is concluded that such systems perform adequately in many situations, but not when the recipient of the warning signal is inside another vehicle. It is suggested that alternative means be developed for warning the occupants of vehicles of immediate danger, so that audible warning systems of reduced acoustic power can be used to warn pedestrians and others.

Search terms: Audio warning devices; Emergency signaling devices; History; Noise control; Acoustic measurement; Noise tolerances; Evaluation; Warning system effectiveness

## 3/3 Cyclists

**HS-011 733 Fld. 3/3**

### WHEELING AND DEALING WITH TRAFFIC

by E. A. Sloane

Published in *Family Safety* p12-4 (Spring 1972)

Recommendations to cyclists for safer city bicycle riding are presented. Possible traffic hazards are pointed out. Bicycle equipment and clothing are also discussed.

Search terms: Bicycle safety; Bicycle handling; Accident prevention; Hazard perception; Helmets; Vehicle lighting; Reflectors; Protective clothing; Bicycle rider behavior; Child safety

## 3/6 Driver Licensing

**HS-011 734 Fld. 3/6**

### MICHIGAN DRIVER PROFILE

by J. W. Little

Michigan Univ. Hwy. Safety Res. Inst.

1968 58p
Report no. HSRI-PuF-6

The profile of driver characteristics and behavior was constructed from a 1967 sample from official driver records of 1,084 drivers. Data selected include: license number, type, origin, status, and restrictions; licensee's sex, month and year of birth, physical handicaps, epileptic or other seizures; driver education courses completed; accident information; conviction data; suspensions and revocations; and driver improvement activity (warning letters, re-examination referrals). Twenty-five tables of data are presented. Associations between accidents and driver age, license restrictions, revocations, driver education, convictions, etc., are shown.

Search terms: Driver statistics; Michigan; Driver characteristics; Driver age; Driver education; Driver improvement; Driver license restrictions; Driver license revocation; Driver license suspension; Driver licenses; Point systems; Driver physical fitness; Driver records; Driver sex; Traffic law violations; Accident rates; Accident records; Accident repeater drivers; Driver behavior; Sampling; Problem drivers; Convictions

**HS-011 735 Fld. 3/6; 3/9**

### THE ROLE OF MEDICAL ADVISORY BOARDS IN DRIVER LICENSURE

by L. N. Hames

Published in *Traffic Digest and Review* v20 n2 p13-6 (Feb 1972)

15refs

Studies have indicated that physical and mental impairments are serious factors in the highway injury and death toll. The problem of identifying and removing the impaired driver from the road, either temporarily or permanently, however, has proved to be complicated and often frustrating. One of the most effective solutions is the formation of a medical advisory board for driver licensing. The development of medical advisory boards and a brief summary of the procedures of the Texas board are presented.

Search terms: Medical advisory boards; Driver license restrictions; Driver licensing; Driver mental fitness; Driver physical fitness; Driver physical examinations; Medical factor caused accidents; Driver license examiners; Texas; Handicapped drivers; Driver license standards

# 4/0 OTHER SAFETY-RELATED AREAS

## 4/1 Codes and Laws

HS-011 736 Fld. 4/1

### PROPOSED HIGHWAY CODE FOR GEORGIA. REVISION, CODIFICATION AND COMPILATION OF GEORGIA HIGHWAY LAW. FINAL REPORT. PHASE 1

by R. C. Kates

Georgia Univ.

1971 578p

Prepared for the State Hwy. Dept. of Georgia, GHD Research Project 6801, in cooperation with the Bureau of Public Roads.

The Laws of the State of Georgia affecting the State Highway Department of Georgia are extracted and classified in order to make an in-depth review of the legal framework for the operation of the department and propose legislation to implement desirable revision and reorganization of the Georgia Code and document the desirability of the proposed legislation.

Georgia; Traffic laws; Vehicle laws; State highway departments; Financing; Utilities; Railroads; Crime; Tolls; Bridges; State laws; Highway management; Highway classification; Highway economic factors; Highway construction

## 4/7 Mathematical Sciences

HS-011 737 Fld. 4/7; 5/1; 5/10

### APPLICATION OF SIMULATION TO ASSESSMENT OF COMPONENT CHANGES ON REAR END HIGHWAY ACCIDENTS

by W. L. Carlson

Published in *Transportation Science* v6 n1 p1-14 (Feb 1972)

18refs

Study performed in part under contract with National Highway Safety Bureau.

This paper illustrates the simulation method of evaluating the effect of system component changes on highway crash reduction. The evaluation procedure presented uses operating characteristics of a component as input, and compares the performance of alternative components in emergency traffic conflict situations. It is shown that Monte Carlo simulation of the model may be an efficient technique for comparing component alternatives. The examples presented involve: the emergency braking capabilities of two populations of vehicles in emergency car-following situations; and two different rear lighting systems.

Search terms: Monte Carlo method; Probability theory; Accident simulation; Tailgating caused accidents; Rear end collisions; Brake systems; Rear lamps; Mathematical models; Following distance; Car following; Impact velocity; Computerized simulation; Accident risk forecasting; Driver emergency responses; Braking distance; Stopping distance; Brake performance; Traffic conflicts

HS-011 738 Fld. 4/7; 5/18

### DEVELOPMENT OF ANALYTICAL AIDS FOR MINIMIZATION OF SINGLE VEHICLE ACCIDENTS. FINAL TECHNICAL REPORT

by R. R. McHenry; N. J. DeLeys

Cornell Aeronautical Lab., Inc.

1971 161p 27 refs
Contract CPR-11-3988
Report no. CAL-VJ-2251-V-10; PB-204 583

This report is a summary of the entire research effort and the preceding nine technical reports, which describe the development of the Highway-Vehicle-Object Simulation Model (HVOSM), some of the uses of HVOSM, to date, and lists the 40 users of HVOSM in both the U. S. and foreign countries. Work on braking dynamics, sprung mass impact, and full-scale impact tests with bridge rails for simulation validation is described. It is concluded that HVOSM is uniquely suited for studies of vehicle motions that occur immediately prior to and during accidental departures from the roadway and of the driving task under emergency conditions. Detailed dynamics of cornering and ride motions, with braking or tractive effort, on pavement that includes surface irregularities and/or nonuniform friction properties can also be studied.

Search terms: Single vehicle accidents; Computerized simulation; Simulation models; Computer programs; Braking; Front suspension systems; Cornering; Torque; Rear axles; Curbs; Tire side forces; Front wheels; Rear wheels; Icy road conditions; Impact tests; Vehicle dynamics; Collision models; Barrier collision tests; Bridge parapets; Transducers; Lateral acceleration; Vehicle trajectories; Vehicle mass; Railroad grade crossings; Driving task analysis; Driver emergency responses; Mathematical models; Roll; Camber; Tire slip motion; Tire traction; Instrumented vehicles; Damage patterns; Deflection; Vehicle road interface

AVAILABILITY: NTIS

## 4/8 Transportation Systems

HS-011 739 Fld. 4/8

### INTERSOCIETY CONFERENCE ON TRANSPORTATION, WASHINGTON, D. C., MAY 31-JUNE 2, 1972. PROCEEDINGS

Society of Automotive Engineers, Inc.

1972 270p refs

Thirty-one papers are included on urban transportation planning, freight transportation, personal rapid transit, marine transportation, pipelines, regulation of transportation, automobile marketing, and air transportation.

Search terms: Transportation planning; Urban transportation; Freight transportation; Marine transportation; Air transportation; Personal rapid transit; Pipelines; Regulations; Federal control; Automobile markets

AVAILABILITY: SAE

**HS-011 740 Fld. 4/8; 3/8**

### INTERNATIONAL CONFERENCE ON TRANSPORTATION AND THE ENVIRONMENT, PT. 1. PROCEEDINGS

Society of Automotive Engineers, Inc.

1972 436p refs
Report no. SAE-P-44

Cosponsored by Environmental Protection Agency and Dept. of Transp. Includes HS-011 718 - 723, 732, 744 - 745, 761 - 769

Papers are included on: transportation planning and forecasting, locomotive air pollution; truck emissions; the environment and the bus; earthmover air pollution; aircraft emissions; the future of gasoline engines; alternative powerplants; future automotive fuels; auto emissions; aircraft, auto, truck, and construction noise; air pollution and the environment; DDT environmental effects; warning device noise; environmental impact of transportation systems; rapid transit systems; and low emission vehicles.

Serach terms: Transportation planning; Transportation systems; Rail transportation; Vehicle air pollution; Aircraft air pollution; Experimental engines; Fuels; Emission control; Noise control; Air pollution control; Environmental factors; Forecasting; Rapid transit systems

**HS-011 741 Fld. 4/8; 4/7**

### SOME OBSERVATIONS ON THE TIME DISTRIBUTION OF DEMAND FOR BUS TRANSPORT

by G. R. Webb

Published in *Australian Road Research* v4 n7 p47-52 (Nov 1971)

3refs

Some simple models are used to demonstrate the way in which unit bus costs are raised by peaks in demand, poor back loading, and variations in trip length. Several means of reducing unit costs are then considered, namely off-peak charter work and the employment of part-time bus crews. The latter measure could lead to a significant saving in wage costs, but so far has not been adopted in Australia.

Search terms: Bus usage; Public transportation costs; Economic analysis; Australia; Peak hours; Vehicle operating costs; Time costs; Trip distribution models; Trip length

## 5/0 VEHICLE SAFETY

**HS-011 742 Fld. 5/0**

### PERFORMANCE IS KEY TO CHANGING AUTO STANDARDS

by J. M. Callahan

Published in *Automotive Industries* v146 n4 p39-43 (15 Feb 1972)

An interview with Robert Carter, acting associate administrator for the motor vehicle programs of NHTSA, is presented. The most important new product is the program plan book that describes the future goals of the NHTSA standards office. A detailed chart shows the future Motor Vehicle Safety Standards. These include occupant compartment systems, vehicle crash energy management systems, motorcycle rider protection system, vehicle handling and stability systems, visibility systems, and driver environment systems.

Search terms: Vehicle safety standards; Restraint systems; Rule making; Injury costs; Government industry cooperation

## 5/4 Design

**HS-011 743 Fld. 5/4**

### SAFETY CARS: A CRUSADE TURNING SOUR?

by J. R. Daniels

Published in *Autocar* v135 n3945 p41-4 (11 Nov 1971)

A discussion of experimental safety vehicles (ESVs) is presented. The American ESV specification is criticized as being unrealistic (car too heavy, too costly, 50 mph barrier-collision survivability unrealistic, etc.). Japan's ESV work is praised for its complete openness about its mistakes and weaknesses. German ESV work on a smaller (one ton) vehicle by Opel is noted. ESVs built by Fairchild, AMF, Ford, and General Motors are briefly discussed. Air bags are denounced, particularly the possible danger of an accidental inflation and the resulting accidents.

Search terms: Safety cars; Automobile safety characteristics; Air bag restraint systems; Japanese vehicles; Experimental automobiles; Chassis design; Crashworthiness; Safety design; Vehicle weight; European vehicles; Vehicle size

**HS-011 744 Fld. 5/4; 5/6**

### FUTURE OF GASOLINE ENGINES

## 5/4 Design (Cont'd.)

**HS-011 744 (Cont'd.)**

by A. G. Lucas; G. W. Niepoth

General Motors Corp.

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p94-102

16refs
Report no. SAE-720615

The present spark ignition, reciprocating piston, gasoline engine is examined against the basic requirements for an automotive powerplant. The important requirement of emission control is shown to affect these basic requirements. The emission potential of this engine and the prospect of reducing its emissions to an acceptable level are explored. The effect of these factors on future gasoline engines is discussed.

Search terms: Automobile engines; Forecasting; Engine noise; Evaporative emission control; Exhaust emission control; Crankcase emission control; Noise control; Engine performance; Exhaust emission control devices; Rotary engines

**HS-011 745 Fld. 5/4; 5/15**

### PROSPECTS FOR ALTERNATE POWERPLANTS

by J. Brogan

Environmental Protection Agency

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p103-7

Report no. SAE-720616

The Clean Air Act Amendments of 1970 require that new model automobiles of 1976 and later meet stringent exhaust emission standards. The technical difficulties appearing in "clean-up" of the conventional automobile engine require that alternate engines be developed in the event that the conventional engine cannot be made to meet the standards. Although the alternates cannot be mass produced by 1976, prototype engine development and demonstration by that date may lead to decisions to mass produce one or more in the early eighties. Features of the major alternate engine systems are reviewed, and projections are made of the prospects of each as a replacement for the conventional engine.

Search terms: Exhaust emission control; Propulsion systems; Forecasting; Experimental engines; Exhaust emission standards

## 5/6 Fuel Systems

**HS-011 746 Fld. 5/6**

### IIEC, INTER-INDUSTRY EMISSION CONTROL. PROGRESS REPORT, MAY 1972

Society of Automotive Engineers, Inc.

1972 211p refs
Report no. SAE-SP-370

Includes HS-011 747 – HS-011 756

The IIEC has been conducting extensive research efforts in an attempt to meet its revised emission objectives which are based on the very severe 1976 vehicle emission standards established by the Clean Air Act Amendment of December 31, 1970. These new IIEC emission targets required at low vehicle mileage are based on a very minimal anticipated depreciation in emission control performance with mileage accumulation. The research results of the last sixteen months of development by the IIEC are documented, and ten papers on aspects of emission control are included.

Search terms: Exhaust emission control; Exhaust emission standards; Inter Industry Emission Control Program

AVAILABILITY: SAE

**HS-011 747 Fld. 5/6**

### STATUS REPORT ON HC/CO OXIDATION CATALYSTS FOR EXHAUST EMISSION CONTROL

by P. W. Snyder; W. A. Stover; H. G. Lassen

Mobil Res. and Devel. Corp.; Ford Motor Co.

Published in HS-011 746, *IIEC Inter-Industry Emission Control* (SP-370), New York, 1972

23p 15refs
Report no. SAE-720479

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972, and API Refining Div. Meeting, New York, 8-11 May 1972.

The need for minimizing the time required after engine start-up to begin converting exhaust emissions is discussed. Four major improvements in catalytic HC/CO converters have been made in the past year to reduce catalyst ignition time: use of low thermal capacity monolithic catalyst supports; locating converter after thermal reactor and/or closer to the exhaust manifold; development of catalysts with superior stability to long exposure at high temperature; and development of catalysts with improved low temperature activity. Small laboratory samples of potential HC/CO oxidation catalysts were screened for activity in a laboratory simulated cold-start test with exhaust from a two-cylinder engine.

Search terms: Inter Industry Emission Control Program; Oxidation catalysts; Hydrocarbons; Carbon monoxide; Exhaust gases; Exhaust emission control; Nitric oxide; Catalytic converters;

Ignition temperature; Ignition timing; Coldstarts; Engine dynamometers; Monolithic catalysts; Pelleted catalysts; Exhaust emission standards; Exhaust emission tests; Durability tests; Catalyst tests; Heat resistance; Temperature endurance tests; Laboratory tests; Thermal factors; Mathematical models

**HS-011 748 Fld. 5/6**

## NOx REDUCTION CATALYSTS FOR VEHICLE EMISSION CONTROL

by G. H. Meguerian; F. W. Rakowsky; E. H. Hirschberg; C. R. Lang; D. N. Schock

American Oil Co.; Ford Motor Co.

Published in HS-011 746, *IIEC, Inter-Industry Emission Control* (SP–370), New York, 1972

25p 9refs
Report no. SAE-720480

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972 and API Refining Div. Meeting, New York, 8-11 May 1972.

IIEC (Inter-Industry Emission Control) efforts to develop $NO_x$ catalysts with improved durability have continued. Properties of several nickel oxide catalysts on pelleted, monolithic ceramic, and metallic supports are discussed and the engineering requirements for their effective use are defined. Some promoted nickel oxide, pelleted catalysts show good low temperature activity, and produce minimal amounts of ammonia but are strongly deactivated by sulfur in the feed gas. Monolithic and metallic catalysts, on the other hand, although not active at temperatures below 1000°F, are very active at higher temperatures where deactivation by sulfur and ammonia formation are not troublesome.

Search terms: Inter Industry Emission Control Program; Reduction catalysts; Nitrogen oxides; Ammonia; Exhaust emission control; Exhaust gases; Nickel oxides; Engine dynamometers; Pelleted catalysts; Monolithic catalysts; Carbon monoxide; Sulfur; Coldstarts; Thermal factors; Catalyst tests; Durability tests; Performance tests; Dual bed catalyst systems; Heat resistance

**HS-011 749 Fld. 5/6**

## METHODS FOR FAST CATALYTIC SYSTEM WARM-UP DURING VEHICLE COLD STARTS

by W. E. Bernhardt; E. Hoffmann

Volkswagenwerk A.G. (West Germany)

Published in HS-011 746, *IIEC, Inter-Industry Emission Control* (SP-370), New York, 1972

24p 7refs
Report no. SAE-720481

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

During vehicle cold start, emissions, mass flow rates, and catalytic conveter space velocities vary by orders of magnitude. Therefore, catalytic exhaust control systems must be designed to operate at high efficiency almost from the moment of engine start-up. Catalysts must reach their operating temperature as quickly as possible. Therefore, the utility of different methods for improving the warm-up characteristics of catalytic systems is illustrated. A very elegant method to speed the warm-up is the use of the engine itself as a "preheater" for the catalytic converters. High exhaust gas enthalpy to raise exhaust system mass up to its operating temperature is obtained by the use of extreme spark retard, stochiometric mixtures, and fully opened throttle. Intensive studies to investigate the effects of concurrent changes of spark timing and air/fuel mixtures on exhaust gas temperature, enthalpy, $NO_x$ and HC emissions are discussed. $NO_x$ catalyst characteristics are dealt with.

Search terms: Inter Industry Emission Control Program; Coldstarts; Exhaust gases; Exhaust emission control devices; Exhaust systems; Fuel mixtures; Hydrocarbons; Nitrogen oxides; Thermal factors; Catalysts; Operating temperature; Ambient temperature effect on exhaust; Hydrocarbons; Enthalpy; Carbon monoxide; Throttling; Thermodynamics; Dual bed catalyst systems; Pelleted catalysts; Monolithic catalysts; Catalytic converters; Gas motion; Ignition timing; Spark timing; Air fuel ratio; Oxidation; Engine performance; Performance tests; Engine operating conditions; Engine speeds; Low temperature; Durability tests; Exhaust gas recirculation

**HS-011 750 Fld. 5/6**

## ENGINE TESTING OF CATALYSTS–CONVERSION VERSUS INLET CONDITIONS

by P. Oser; D. H. Pundt; W. Buttergeit

Volkswagenwerk A.G. (West Germany)

Published in HS-011 746, *IIEC, Inter-Industry Emission Control* (SP-370), New York, 1972

13p
Report no. SAE-720482

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

A test procedure to determine the conversion performance of oxidation and reduction catalysts for the treatment of automotive engine exhaust gases is described. The variable parameters are the air/fuel ratio, the secondary air quantity, and the space velocity. Characteristic results with noble metal catalysts on monolithic supports and pelleted base metal catalysts are shown.

## 5/6 Fuel Systems (Cont'd.)

### HS-011 750 (Cont'd.)

Search terms: Inter Industry Emission Control Program; Engine tests; Exhaust gases; Oxidation catalysts; Air fuel ratio; Carbon monoxide; Hydrocarbons; Exhaust emission control device tests; Nitric oxide; Ammonia; Catalytic converters; Reduction catalysts; Catalyst tests; Monolithic catalysts; Mathematical models

### HS-011 751 Fld. 5/6

### MITSUBISHI STATUS REPORT ON LOW EMISSION CONCEPT VEHICLES

by Y. Kaneko; Y. Kiyota

Mitsubishi Motors Corp. (Japan)

Published in HS-011 746, *IIEC, Inter-Industry Emission Control* (SP-370), New York, 1972

13p 1ref
Report no. SAE-720483

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

Experience indicates that an effective dual catalytic converter, consisting of a $NO_x$ catalyst and a HC/CO catalyst, is indispensable to achieve the stringent IIEC (Inter-Industry Emission Control) targets, established on the basis of 1976 Federal Standards. However, there still remains a major difficulty of meeting the $NO_x$ target since NO is regenerated in the HC/CO catalyst in the dual converter system. This paper describes major efforts in seeking a breakthrough to control the $NO_x$ emission, and covers some noteworthy findings on transient NO concentrations at the inlet and outlet of HC/CO converter in an experimental dual converter.

Search terms: Exhaust gases; Exhaust emission control; Nitric oxide; Nitrogen oxides; Hydrocarbons; Carbon monoxide; Coldstarts; Dual bed catalyst systems; Air fuel ratio; Inter Industry Emission Control Program; Exhaust emission standards; Catalytic converters; Exhaust emission control device tests

### HS-011 752 Fld. 5/6

### ECONOMICAL MATCHING OF THE THERMAL REACTOR TO SMALL ENGINE-LOW EMISSION CONCEPT VEHICLES

by H. Kuroda; Y. Nakajima; Y. Hayashi; K. Sugihara

Nissan Motor Co. Ltd. (Japan)

Published in HS-011 746, *IIEC, Inter-Industry Emission Control* (SP-370), New York, 1972

16p 10refs
Report no. SAE-720484

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

The Inter-Industry Emission Control (IIEC) Program included the thermal reactor as one of the effective ways of oxidizing HC and CO in the exhaust system. However, this was accompanied by very substantial fuel economy penalties, especially in the case of small engine-low emission concept vehicles. Starting with a new concept aimed at obtaining the HC/CO oxidizing trigger temperature in the thermal reactor by modifying engine settings, the authors arrived at an economical technique of matching the thermal reactor to the engine.

Search terms: Exhaust gases; Exhaust emission control devices; Oxidation; Hydrocarbons; Carbon monoxide; Thermal reactors; Air flow rates; Fuel economy; Combustion rate; Ignition timing; Air fuel ratio; Fuel economy; Inter Industry Emission Control Program; Engine operating conditions; Engine size; Operating temperature; Air injection

### HS-011 753 Fld. 5/6

### FIAT STATUS REPORT ON LOW EMISSION CONCEPT VEHICLES

by C. Pollone

Fiat S.p.A. (Italy)

Published in HS-011 746, *IIEC, Inter-Industry Emission Control* (SP-370), New York, 1972

17p
Report no. SAE-720485

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

The work reported has been done in the last year as part of Fiat's collaboration with the Inter-Industry Emission Control Program. Emission results obtained on two concept cars are shown, including respectively: thermal reactor, exhaust gas recirculation (EGR), HC/CO catalytic converter, and $NO_x$ and HC/CO catalytic converters. Work is also reported on screening of materials for thermal reactors and catalysts.

Search terms: Materials tests; Thermal reactors; Exhaust emission tests; Exhaust gas recirculation; Temperature endurance tests; Corrosion tests; Thermal stresses; Durability tests; Catalyst tests; Oxidation catalysts; Hydrocarbons; Nitrogen oxides; Carbon monoxide; Catalytic converters; Inter Industry Emission Control Program

### HS-011 754 Fld. 5/6

### TOYO KOGYO STATUS REPORT ON LOW EMISSION CONCEPT VEHICLES

by K. Tanaka; M. Akutagawa; K. Ito; Y. Higashi; K. Kobayashi

Toyo Kogyo Co. Ltd. (Japan)

Published in HS-011 746, *IIEC, Inter-Industry Emission Control* (SP-370), New York, 1972

25p 14refs
Report no. SAE-720486

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

Three concept emission control package systems were selected as showing promise. These package systems incorporate component systems such as thermal reactors, EGR (exhaust gas recirculation system), catalytic converters, and other subcomponents to assist these main component systems. None of these package systems have reached the stage of satisfying the HC/CO targets over extended vehicle mileage, or the $NO_x$ target, even at zero vehicle miles. The durability of these package systems has been revealed as unsatisfactory. Frequent maintenance operations are required to adjust or replace the component devices in order to maintain very low emission levels during the course of the durability mileage.

Search terms: Exhaust emission control devices; Exhaust gas recirculation; Thermal reactors; Catalytic converters; Hydrocarbons; Carbon monoxide; Nitrogen oxides; Air fuel ratio; Fuel mixtures; Ignition timing; Operating temperature; Catalyst tests; Engine dynamometers; Coldstarts; Durability tests; Oxidation catalysts; Reduction catalysts; Pelleted catalysts; Monolithic catalysts; Inter Industry Emission Control Program; Temperature endurance tests

**HS-011 755 Fld. 5/6**

### TOYOTA STATUS REPORT ON LOW EMISSION CONCEPT VEHICLES

by T. Inoue; K. Goto; K. Matsumoto

Toyota Motor Co., Ltd. (Japan)

Published in HS-011 746, *IIEC, Inter-Industry Emission Control* (SP-370), New York, 1972

22p
Report no. SAE-720487

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972.

Components studied were direct flame type after-burner, catalytic converter, lead trap for catalyst, thermal reactor, and three types of exhaust gas recirculation (EGR) systems: air cleaner entry EGR, above the throttle valve EGR, and manifold EGR. In parallel with component studies, some engine modifications such as choke system, camshaft overlap, combustion chamber configuration, and ignition system were also investigated. The present stage of Toyota's development of the following combination systems and their components is reported in this paper: Package I: $NO_x$ and HC/CO catalytic converter and EGR. Package II: thermal reactor, catalytic converter, and EGR.

Search terms: Exhaust emission tests; Exhaust emission control devices; Exhaust gas recirculation; Afterburners; Catalytic converters; Thermal reactors; Throttle valves; Engine performance; Nitrogen oxides; Hydrocarbons; Carbon monoxide; Exhaust valve design; Dual bed catalyst systems; Fuel economy; Insulation; Thermal factors; Air fuel ratio; Spark timing; Operating temperature; Inter Industry Emission Control Program; Exhaust manifolds; Engine speeds

**HS-011 756 Fld. 5/6**

### FORD DURABILITY EXPERIENCE ON LOW EMISSION CONCEPT VEHICLES

by R. M. Campau; A. Stefan; E. E. Hancock

Ford Motor Co.

Published in HS-011 746, *IIEC, Inter-Industry Emission Control* (SP-370), New York, 1972

31p 23refs
Report no. SAE-720488

Presented at National Automobile Engineering Meeting, Detroit, 22-26 May 1972 and API Refining Div. Meeting, New York, 8-11 May 1972.

Recent vehicle durability experience with low emission concept hardware systems is described. The low-emission concept systems discussed include: thermal reactor only, a combined thermal reactor and HC/CO monolithic catalyst system, and a system combining low thermal inertia exhaust manifolds with dual-bed ($NO_x$ and HC/CO) catalytic converters. Problems shown to influence either emission performance or vehicle function during both atypical and normal vehicle operation include: the melting of monolithic structures used to support both the $NO_x$ and the HC/CO catalytic promoters, the deleterious effect of the sulfur content of gasoline on the performance of pelleted $NO_x$ catalysts, and the loss of emission control with malfunctioning engine components.

Search terms: Exhaust emission control devices; Exhaust manifolds; Dual bed catalyst systems; Hydrocarbons; Carbon monoxide; Nitrogen oxides; Sulfur; Coldstarts; Thermal reactors; Catalytic converters; Exhaust gas recirculation; Hotstarts; Monolithic catalysts; Durability tests; Pelleted catalysts; Fuel composition; Catalyst tests; Inter Industry Emission Control Program; Fuel economy; Engine operating conditions; Exhaust emission standards; Exhaust emission tests

**HS-011 757 Fld. 5/6**

### REACTIVITIES OF EXHAUST ALDEHYDES

by B. Dimitriades; T. C. Wesson

## 5/6 Fuel Systems (Cont'd.)

**HS-011 757 (Cont'd.)**

Published in *Journal of the Air Pollution Control Association* v22 n1 p33-8 (Jan 1972)

15refs
Report no. Paper-71-74

Prepared in cooperation with the Air Pollution Control Office of the Environmental Protection Agency. Presented at the 64th annual meeting of the Air Pollution Control Assoc., Atlantic City, 1971.

Experimental data on smog-forming reactivities of aldehydes were obtained in studies using a photoirradiation chamber. The aldehydes were studied both individually and in mixture typical of mixtures that appear in auto exhaust. Results showed reactivities of the aldehydes to differ greatly. As a group, the aldehydes in exhaust are judged to be as reactive as the olefin group. The aldehyde contribution to exhaust reactivity and methods for assessing such contribution are discussed.

Search terms: Aldehydes; Organic air pollutants; Exhaust emissions reactivity; Olefins; Chemical analysis; Hydrocarbons; Smog chambers; Exhaust composition; Photochemical reactions

**HS-011 758 Fld. 5/6**

### COMPOSITION, SIZE AND CONTROL OF AUTOMOTIVE EXHAUST PARTICULATES

by G. L. Ter Haar; D. L. Lenane; J. N. Hu; M. Brandt

Published in *Journal of the Air Pollution Control Association* v22 n1 p39-46 (Jan 1972)

14refs
Report no. Paper-71-111

Presented at the 64th annual meeting, Air Pollution Control Association, Atlantic City, 1971.

Results of the study on 1966-70 cars operated on a chassis dynamometer under Federal 7-mode cycle conditions show that: cars vary widely in the amounts and composition of their particulate emissions; cold-cycle operation gives 2-8 times more particulate than hot-engine operation; lead compounds represent less than one-third of total particulates; carbon emission for stabilized cars using leaded gasoline varies widely, but averages about 35% of the total; suspended particulate emissions are nearly equal with new cars whether or not lead is present; exhausted lead varies with the condition of the exhaust system and ranges between 7 and 30% of the lead consumed by the engine; fuel additives affect the amount of emitted particulates; probe sampling techniques underestimate the amount of particulates emitted; and trapping systems offer potential for greatly reducing the emission of suspended total particulates.

Search terms: Particulate air pollutants; Exhaust emissions; Particulate traps; Exhaust composition; Particle size analysis; Lead; Chassis dynamometers; Exhaust emission control; Carbon; Lead free gasoline; Leaded gasoline; Fuel additives; Exhaust emissions sampling; Exhaust emission tests; Engine operating conditions; Exhaust emissions measurement

**HS-011 759 Fld. 5/6**

### CAN YOU AFFORD (NOT) TO BREATHE?

by P. S. Myers

Published in *Journal of Automotive Engineering* v80 n4 p20-7 (Apr 1972)

4refs

If an irrational approach to the control of emissions is followed, costs can easily be 5-10 times as much as they should be. If this happens, pollution backlash will occur, with the result that needed reductions will not be achieved. Various cost curves for air pollution control are included. Costs associated with removal of specific pollutants (hydrocarbons, oxides of nitrogen, carbon monoxide, particulates) are projected.

Search terms: Emission control; Air pollution control costs; Particulate air pollutants; Hydrocarbons; Nitrogen oxides; Carbon monoxide; Exhaust emissions; Air pollutant concentration standards; Automobile costs; Emission standards

**HS-011 760 Fld. 5/6**

### LUBRICATING ROTARY ENGINES

by T. W. Rogers; T. Ohzawa; J. LeFevre; W. Lemke

Published in *Automotive Engineering* v80 n5 p23-31 (May 1972)

Based on SAE-720467, prepared for presentation at SAE Automobile Meeting 22-26 May 1972.

Investigations of lubricant requirements of various water-cooled rotary combustion engine designs have been carried out with three different modes of testing. First, laboratory bench test investigations were made to study specific lubricating problem areas of: carbon-type apex seal chipping; piston ring steel-type apex seal wear under low temperature stop-and-go conditions; and trochoid surface chatter wear under high-speed operation. Oil formulation technology which has indicated good performance in laboratory engines was then evaluated in an extended chassis rolls highway simulator test and finally in road durability testing. Characteristics of the engines and lubricants in this study are listed in tables.

Search terms: Rotary engines; Lubricating oils; Apex seals; Engine wear; Lubricating oil tests; Road tests;

Rotors; Air cooled engines; Combustion chamber deposits; Engine tests; Laboratory tests; Engine operating conditions; Engine speeds; Low temperature

**HS-011 761 Fld. 5/6**

### SOCIAL AND ECONOMIC IMPLICATIONS OF LOW EMISSION VEHICLES

by R. U. Ayres

International Res. and Technology Corp.

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p387-401

Report no. SAE-720661

The basis for formulating so-called "uniform" emission standards for motor vehicles is examined and found to be inconsistent with the widely accepted principle that "the polluter should pay," if consideration is given to the problems caused by pollution rather than the sources of emissions. Atmospheric pollution problems are geographically limited and also depend upon other variables such as time of day and weather conditions. It is proposed that emissions standards should be made flexible in order to reflect these environmental variations, and thus to achieve the maximum environmental improvement for the least total cost to vehicle owners and users. Several zoning schemes are discussed, having the common feature that cars meeting the most rigorous standards would be required only in zones having the greatest density of vehicles and population (or the greatest propensity for smog). This would affect only a small fraction of the vehicle population.

Search terms: Vehicle air pollution; Air pollution control; Exhaust composition; Environmental factors; Urban areas; Central business districts; Vehicle characteristics; Air quality standards; Zoning; Air pollution control costs

**HS-011 762 Fld. 5/6**

### FUTURE AUTOMOTIVE FUELS

by J. C. Ellis

Shell Oil Co.

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p108-21

24refs
Report no. SAE-720617

The future fuel for passenger cars will be a blend of liquid hydrocarbons. Front-end volatiles will be limited by vapor-pressure control to minimize handling losses and to accommodate vapor recovery systems. The use of certain high boiling hydrocarbon constituents will be prohibited by the establishment of distillation specifications to that degree required to provide optimum emissions control at lowest overall system cost. The use of lead alkyl anti-knocks, and other components which are catalyst poisons, will be disallowed. In some geographic areas control of gasoline olefinicity can be expected until today's uncontrolled cars are lost by attrition from the total vehicle population. Aromatic content will, in general, not increase much beyond today's levels. These fuels, which will evolve for the emission controlled reciprocating internal combustion engine, will accommodate any near-future alternate power-plant for passenger cars. Gaseous fuels will be used increasingly by passenger car fleets and trucks in urban areas, but will not be widely distributed for general use by the average motorist.

Search terms: Fuels; Forecasting; History; Fuel additives; Lead; Gasoline quality; Evaporative emission control; Olefins; Aromatic hydrocarbons; Hydrocarbons; Exhaust composition; Fuel properties; Gasoline volatility; Exhaust emission control

**HS-011 763 Fld. 5/6; 4/2**

### AUTOMOTIVE EMISSIONS—WHAT CAN UNIVERSITIES DO?

by D. V. Ragone

Dartmouth Coll.

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p122-4

Report no. SAE-720619

Universities can contribute significantly to the resolution of automotive air pollution problems if they recognize problem-oriented, as well as discipline-oriented approaches to education. In addition to their usual roles, both faculty and students can contribute as unbiased but informed third parties who can validate technical arguments in controversial areas for the public.

Search terms: Vehicle air pollution; Universities; Problem solving

**HS-011 764 Fld. 5/6; 4/4**

### THE FUTURE OF REGULATORY REQUIREMENTS RELATED TO AUTOMOTIVE EMISSIONS

by E. O. Stork

Environmental Protection Agency

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p125-7

Report no. SAE-720620

## 5/6 Fuel Systems (Cont'd.)

**HS-011 764 (Cont'd.)**

Federal regulatory involvement with automotive air pollution is traced from the early 1950's to the present. The process by which the government brings to bear the well being and concerns of the American people in relation to automobile-caused air pollution is examined.

Search terms: Vehicle air pollution; Federal role; Air pollution control

**HS-011 765 Fld. 5/6; 4/8**

### FUTURE TRANSPORTATION AND AIR QUALITY–DOT PROGRAMS

by J. E. Hirten

Department of Transp.

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p292-4

Report no. SAE-720643

The efforts of the Department of Transportation to grapple with the deterioration of air quality due to our present transportation technology are discussed. DOT has a specific environmental impact mandate in its various legislative authorities which includes air pollution and transportation related environmental quality problems.

Search terms: Air pollution control; Transportation planning; Department of Transportation; Federal role

**HS-011 766 Fld. 5/6; 5/2**

### THE ENVIRONMENT AND THE BUS

by R. E. Field

General Motors Corp.

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p28-36

Report no. SAE-720607

Buses have used a number of propulsion systems to try to obtain an efficient, clean operating vehicle. The most important current system is the diesel engine. The components of diesel engine emissions have been studied and progress has been made in reducing them. GMC Truck and Coach has developed and released an environmental improvement program that reduces smoke to the invisible range and meets federal standards for HC, CO, AND $NO_X$. Odor also is eliminated as a problem. The advantages of the gas turbine engine are briefly noted.

Search terms: Buses; Air fuel ratio; Diesel engine exhaust emissions; Exhaust odor control; Smoke control; Exhaust emission control; Noise control; Gas turbine engines; Carbon monoxide; Hydrocarbons; Nitrogen oxides

**HS-011 767 Fld. 5/6; 5/20**

### DIGGING INTO AIR POLLUTION PROBLEMS–AN EARTHMOVER'S VIEWPOINT

by R. D. Henderson

Caterpillar Tractor Co.

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p37-41

3refs
Report no. SAE-720609

The status of emission regulations is commented upon. Estimates of emissions from earth moving vehicles are provided, based on Caterpillar information, and these are compared with diesel powered off-highway machinery based on Bureau of Mines data. It is suggested that simple emission test procedures may suffice for the great variety of equipment used in the construction industry if standards are established, Nonproductive testing to prove conformance to standards should be minimized.

Search terms: Diesel engine exhaust emissions; Exhaust emission standards; Construction equipment; Exhaust emission tests; Exhaust composition; Exhaust emission control

**HS-011 768 Fld. 5/6; 5/20**

### CONSIDERATIONS IN REDUCING TRUCK EMISSIONS IN METROPOLITAN AREAS THROUGH THE IMPROVEMENT OF GOODS-MOVEMENT

by I. J. Rubin

Ford Motor Co.

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p23-7

8refs
Report no. SAE-720606

A reduction in truck emissions in metropolitan areas can be accomplished through the installation of pollution control devices, and the more efficient utilization of trucks in the movement of goods. The government-mandated standards for truck emission control are discussed, and various methods employed or suggested for improving the efficiency of trucks are reviewed. These include off-hours delivery systems as well as alternative vehicle modes for moving goods. It is concluded that improving the efficiency of trucks can reduce congestion and costs to both truckers and shippers, and, at the same time reduce pollution.

Search terms: Trucks; Heavy duty vehicles; Exhaust emission control devices; Exhaust emission standards;

Urban areas; Efficiency; Modal choice; Air pollution control; Traffic congestion; Off peak hours; Freight transportation; Forecasting

**HS-011 769 Fld. 5/6; 5/20**

### CHARACTERISTIC EMISSIONS OF HEAVY CLASS INTERCITY TRUCKS

by M. Sherbinsky

International Harvester Co.

Published in HS-011 740, *International Conference on Transportation and the Environment, Pt. 1. Proceedings* (P-44), New York, 1972 p14-22

3refs
Report no. SAE-720605

The heaviest class of intercity trucks is examined using the 1967 Census of Transportation to establish a representative sample of vehicles with truck-miles as the major delineator. Representative road types and vehicle loading factors are selected. Computer simulation of the vehicle and road is used to establish histograms of percent engine load versus engine RPM. The above is then combined with modal emission levels to allow projection on a weighted truck-mile basis, to the entire intercity population of this class vehicle. Heavy class is defined as over 26000 lb. GVW.

Search terms: Trucks; Heavy duty vehicles; Vehicle size; Vehicle mileage; Histograms; Loading (mechanical); Vehicle characteristics; Speed; Trip length; Exhaust emissions; Exhaust composition; Vehicle air pollution; Forecasting; Engine operating conditions; Computerized simulation

## 5/10 Lighting Systems

**HS-011 770 Fld. 5/10; 5/1**

### SUBJECTIVE EVALUATION OF THE FRONT-MOUNTED BRAKING SIGNAL

by D. V. Post; R. G. Mortimer

Michigan Univ. Hwy. Safety Res. Inst.

1971 17p 2refs
Report no. HuF-TM-1

The concept of a braking signal visible from the front of an automobile was subjectively evaluated by means of a concept survey and usage questionnaire. Thirty-six surveys were distributed to persons who were not familiar with the front brake signal concept. The 18 respondents to this survey indicated that, generally, they thought the front brake light concept had merit, although half of them said that they would not be willing to buy a front brake lamp. Seventeen surveys were completed by persons who used a front brake lamp on their personal cars for a period of one month. These persons also thought that the front brake light concept had merit, but were no more willing to buy a front brake lamp.

Search terms: Questionnaires; Stop lamp location; Consumer acceptance; Front brake lamps

## 5/14 Occupant Protection

**HS-011 771 Fld. 5/14**

### HUMAN VOLUNTEER TESTING OF GM AIR CUSHIONS

by G. R. Smith; S. S. Hurite; A. J. Yanik; C. R. Greer

General Motors Corp.; Saint Joseph's Hosp., Houston, Tex.

1972 11p 10refs
Report no. SAE-720443

Presented at 2nd International Conference on Passive Restraints, Detroit, 22-25 May 1972.

From November 1970 through August 1971 an extensive program of static and dynamic air cushion inflation tests utilizing human volunteers was conducted at Holloman Air Force Base, New Mexico, sponsored by the Department of Transportation. Forty one full cushion deployment static firings were made, with air cushion hardware and seating buck environment designed by General Motors. The static series was followed by 35 dynamic sled firings of human volunteers, beginning at 8.6 g (15.1 mph) and culminating at 21.7 g (31.5 mph). A major objective of both the static and dynamic test series was to identify changes in air cushion design found necessary to improve its protective capability for human beings. Because of the severity of cushion deployment, one modification was made following the initial static tests: The orifice diameter size of the bag inlet was reduced from 1.0 inches to 0.6 inches to diminish the rapidity of bag inflation. This modification proved effective in the dynamic series. As far as the human element in the dynamic series is concerned, no severe injuries beyond erythema, abrasion, contusion, and blister were received. As result of this program, and testing of baboons at Wayne State University, an improved "augmented" GM air cushion is being developed and hopefully will be man-evaluated in the future.

Search terms: Test volunteers; Air cushions; Air bag restraint systems; Impact sleds; Static tests; Dynamic tests; Impact protection; Dummies; Occupant kinematics; Air bag inflation time; Restraint system tests; Air bag deployment forces; Air bag caused injuries; Human deceleration tolerances; Air bag inflation devices

**AVAILABILITY: SAE**

**HS-011 772 Fld. 5/14**

### PRODUCT LIABILITY FOR ACTIVE AND PASSIVE RESTRAINT SYSTEMS

by R. M. Goodman

Goodman, Eden, Robb, Millender, Goodman and Bedrosian

## 5/14 Occupant Protection (Cont'd.)

### HS-011 772 (Cont'd.)

1972 4p 6refs
Report no. SAE-720432

Presented at 2nd International Conference on Passive Restraints, Detroit, 22-25 May 1972.

Problems posed by threatened lawsuits arising out of potential defects in passive restraint systems are discussed. For many years, it was recognized that the manufacturer of an automobile was liable for defects in manufacture or design which produce injuries. Now the question is should part of the cost of claims and verdicts be shifted to the government—this might make the government more responsive to the feasibility of adopting particular safety systems.

Search terms: Passive restraint systems; Automotive industry negligence; Legal responsibility; Defective products; Product safety; Financial responsibility; Litigation; Manufacturers liability; Strict liability

AVAILABILITY: SAE

### HS-011 773 Fld. 5/14

### PASSIVE PRELOADED ENERGY-ABSORBING SEAT BELT SYSTEM. IMPROVED BELT SYSTEMS

by H. P. Willumeit

Volkswagenwerk A.G. (West Germany)

1972 9p
Report no. SAE-720433

Presented at 2nd International Conference on Passive Restraints, Detroit, 22-25 May 1972.

Safety belt restraint systems can be improved by using semi-passive and full passive devices which lead to a high and increasing utilization without a considerable decrease on the user's comfort. Improvements for increased injury protection are given by introducing belt force limiters and devices which eliminate the belt slack at the moment of crash beginning and furthermore give a certain preload to the belts enabling the passenger to take part in the vehicle deceleration almost from crash onset. Results of sled tests complete the description. A final comparison with the airbag shows the higher protection possibilities of belt restraint systems against injuries.

Search terms: Automatic seat belts; Impact protection; Occupant protection; Deceleration tests; Seat belt loading; Seat belt tests; Three point restraint systems; Seat belt slack; Passive restraint systems; Time factors; Crash phase; Loading tests

AVAILABILITY: SAE

### HS-011 774 Fld. 5/14

### THREEPOINT ENERGY-ABSORBING SEAT BELT SYSTEM WITH COMBINED VEHICLE- AND WEBBING-SENSITIVE EMERGENCY RETRACTOR

by U.W. Seiffert; E. Carbon; H. Ristau

Volkswagenwerk A.G. (West Germany)

1972 11p 3refs
Report no. SAE-720434

Presented at 2nd International Conference on Passive Restraints, Detroit, 22-25 May 1972.

The principles of seat belts for the VW-vehicles with a retractor which is sensitive to vehicle deceleration and to webbing acceleration is described. In addition possibilities are shown to reduce the severity index with energy absorbing devices in the seat belt retractor or in the B-pillar-ring. The results show that the requirements from the NHTSA up to Notice No. 16 of Docket 69-7 cannot be fulfilled in relation to the severity index (SI).

Search terms: Vehicle safety standards; Volkswagens; Automatic seat belts; Barrier impact forces; Deceleration tolerances; Impact protection; Webbing; Shoulder harnesses; Three point restraint systems; Impact sleds; Seat belt standards; Seat belt tests; Injury severity index; Time factors; Restraint system design; Seat belt reels; Loading tests; Energy absorption; Seat belt assembly anchorages

AVAILABILITY: SAE

### HS-011 775 Fld. 5/14

### THE AIR BAG CONTROVERSY. A CASE OF OVERINFLATION OR UNDERINFLATION?

by D. L. Schaffer

Allstate Insurance Co.

1972 6p
Report no. SAE-720431

Presented at 2nd International Conference on Passive Restraints, Detroit, 22-25 May 1972.

The air bag is ready and installation in front seat positions is essential at the earliest possible date. There has been almost a conspiracy of silence and a supression of favorable data—thus the media and through it the public are almost completely uninformed, or even worse, misinformed about air bags. An informed public will accept and should demand an air bag system. Minimal utilization of active restraints (lap and shoulder belts) mandates passive restraints (air bags). SAE has a duty to cause a speed-up in the present rate of availability of air bags. The ultimate savings in lives and reduction in serious injuries as well as automobile insurance costs will be gratifying and substantial.

Search terms: Air bag restraint systems; Benefit cost analysis; Insurance costs; Restraint system usage; Consumer acceptance; Safety device costs

**AVAILABILITY: SAE**

**HS-011 776 Fld. 5/14**

### A SEMIPASSIVE SEAT BELT SYSTEM

by D. P. Peck

Triumph Motor Co. (England)

1972 10p 6refs
Report no. SAE-720435

Presented at 2nd International Conference on Passive Restraints, Detroit, 22-25 May 1972.

This paper describes a semipassive seat belt system that was one of a series developed during a program to examine the possibilities of modifying seat belt designs to meet the passive occupant restraint requirements in the original proposed amendment to FMVSS 208. As such, many features are prohibited by the interlock ignition option of the latest amended 208. This semipassive seat belt installation utilizes a system of electrical interlocks to achieve an improved seat belt wearing rate. It is estimated that a usage rate of 95% would be achieved, making it more effective than an air bag.

Search terms: Automatic seat belts; Impact protection; Ignition seat belt interlocks; Potentiometers; Seat belt reels; Shoulder harnesses; Webbing; Dummies; Barrier collision tests; Three point restraint systems; Seat belt tests; Seat belt effectiveness; Seat belt usage; Vehicle safety standards; Passive restraint systems; Inertia reels; Seat belt standards; Sensors; Deceleration tolerances; Air bag restraint systems

**AVAILABILITY: SAE**

**HS-011 777 Fld. 5/14**

### DESIGN APPROACH AND CRASH PERFORMANCE OF AUTOMATIC SEAT BELT SYSTEMS

by G. M. Bradford; J. Broughton; H. Jakob

American Safety Equipment Corp.

1972 7p 2refs
Report no. SAE-720436

Presented at 2nd International Conference on Passive Restraints, Detroit, 22-25 May 1972.

Automatic seat belts are presented as a method of complying with proposed government regulations requiring passive protection against occupant injury from vehicle collisions. Operational models have been installed in current model cars. The proven field performance of belt systems now in cars reducing fatalities and injuries is the fundamental basis for considering the automatic seat belt. Several design approaches for automatic seat belts are explored and described. Webbing and hardware modifications to adapt the configuration of the belt systems to present car interiors are described in detail. Dynamic testing results are presented to compare crash performance to current production belt systems now in cars.

Search terms: Automatic seat belts; Dynamic tests; Webbing; Impact protection; Webbing elongation; Seat belt design; Seat belt tests; Seat belt assembly anchorages; Seat belt standards; Occupant protection; Passive restraint systems; Loading tests; Performance tests; Vehicle safety standards

**AVAILABILITY: SAE**

**HS-011 778 Fld. 5/14**

### STARTER-INTERLOCK SYSTEMS AS PASSIVE RESTRAINTS

by C. H. Pulley

American Safety Belt Council, Inc.

1972 6p 15refs
Report no. SAE-720437

Presented at 2nd International Conference on Passive Restraints, Detroit, 22-25 May 1972.

The Ford test program, the NHTSA and GSA programs, and others have demonstrated beyond doubt that the starter-interlock system could become popular enough to increase belt use to the 75-90% ratio that is desired. Here is a simple, readily available means of increasing safety harness protection. This device requires no extensive, long-term development but merely adaptation to various model cars. It is available now, and can be installed in production quantities for very little cost on all new cars within a matter of weeks. It has the added advantage that it can be retrofitted to older model cars that already have safety belt fittings. There is a second means of quickly and dramatically increasing safety belt usage: mandatory use laws passed by the state and cities. Usage tests were conducted in Houston, Minneapolis, and Washington, D.C.

Search terms: Ignition seat belt interlocks; Seat belt usage; Three point restraint systems; Shoulder harnesses; Consumer acceptance; District of Columbia; Houston; Minneapolis; State laws; Passive restraint systems; Seat belt legal factors

**AVAILABILITY: SAE**

## 5/15 Propulsion Systems

**HS-011 779 Fld. 5/15**

### WHATEVER HAPPENED TO THE GAS TURBINE

by E. Eves

## 5/15 Propulsion Systems (Cont'd.)

HS-011 779 (Cont'd.)

Published in *Autocar* v135 n3952 p4-7 (30 Dec 1971)

The gas turbine as an automotive power unit is becoming cheaper to make while the piston engine becomes more expensive. It is less complicated and far lighter than a steam engine. It does not have the speed limitations of the Wankel nor wasteful way of controlling emissions necessary with that engine. It is infinitely more efficient than a battery-powered electric car, or even the hybrid electric vehicles with their inherent motor losses. The principles of the gas turbine engine are described and illustrated.

Search terms: Gas turbine engines; Engine design; Engine performance

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HS-011 780 Fld. 5/15

### WHY WANKEL?

by A. Perrow

Published in *Motor* v136 n6 p37-9, 76 (Dec 1971)

The Wankel engine is the closest in design to the ICP engine of all the proposed alternate powerplants for cutting down emissions. Most of the present service equipment, tools, and know-how could be used in servicing and repairing the Wankel engine. Turbine or electric cars, on the other hand, would make obsolete all present servicing procedures, tools, and equipment. The various basic systems of a typical Wankel engine are described and the advantages and disadvantages of the rotary engine are listed.

Search terms: Rotary engines; Wankel engines; Engine design; Engine performance

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## 5/22 Wheel Systems

HS-011 781 Fld. 5/22

### RECENT STUDIES GIVE UNIFIED PICTURE OF TIRE NOISE

by W. Flanagan

Published in *Journal of Automotive Engineering* v80 n4 p15-9 (Apr 1972)

Data from key sources now establish a fairly consistent picture of truck tires as a noise source. Tire sound increases with rising speed, load, and wear. Recaps of an older design are noisier than original cross lug tires which, in turn, are noisier than rib designs. It was possible to compare four separate studies because each used basically the same procedure to measure sound pressure level. Using different trucks on different sites, the studies agree that tires fall into three clearly defined categories as noise producers. Loudest are older recapped tires, particularly the pocket retread. In cross lug tires vibrations induced in tread elements spread to the sidewalls and the air. Lateral elements of cross lug tires may wear into pockets and produce noise the same way. Less noisy are the crossbar tires and the least noisy is the circumferential rib tire. Rankings within tire noise categories may shift as the road surface changes from concrete to asphalt, but the categories remain distinct.

Search terms: Tire noise; Truck tires; Retreaded tires; Acoustic measurement; Tire treads; Tire wear; Tire tread depths; Tire loads; Tire inflation pressure; Tire pavement interface; High speed; Spectral analysis

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## NHTSA DOCUMENTS

## NHTSA Contractors Reports

HS-800 562 Fld. 1/3

### MULTIDISCIPLINARY INVESTIGATIONS OF HIGHWAY TRAFFIC ACCIDENTS. FINAL REPORT

by L. B. West; A. C. Nelson, Jr.; F. C. Tyner

Research Triangle Inst.

1972 237p
Contract DOT-HS-022-1-095
Report no. 43 U-636-FR

Report for 15 Mar 1971 - 29 Feb 1972.

The work on 35 multidisciplinary accident investigations is summarized. A description of the investigation process and an elementary analysis of the results is presented. Recommendations are made with respect to some of the Highway Safety Program Standards and Motor Vehicle Safety Standards.

Search terms: Accident investigation; Accident case reports; Accident causes; North Carolina; Impact forces; Highway safety standards; Vehicle safety standards; Impact angle; Speed patterns; Multidisciplinary teams; Injury severity; Restraint system effectiveness; Impact velocity; Environmental factors; Human factors; Accident scale drawings; Injuries by seat occupation; Injuries by vehicle age; Accidents by vehicle make; Damage severity index; Driver characteristics; Accident report forms; Accident types; Crash phase; Precrash phase; Postcrash phase; Secondary collisions

AVAILABILITY: NTIS

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HS-800 570 Fld. 3/1; 3/4

### THE EFFECTS OF ALCOHOL ON PERFORMANCE IN A DRIVING SIMULATOR OF ALCOHOLICS AND SOCIAL DRINKERS. FINAL REPORT

by H. Moskowitz

California Univ. ITTE

1971 82p 56refs
Contract FH-11-7305
Grant MH-18088
Report no. ITTE-7205

Partial supported by the National Inst. of Alcohol Abuse and Alcoholism.

The primary purpose was to test theoretical explanation of how alcohol affects driving behavior. Experimental methods involved two ITTE human performance laboratories to test both concentrated attention and divided attention. Study clearly revealed performance decrements occur at BAL's below 0.10%. Effects were found to be related to the divided-attention aspects of the driving task, rather than to vehicle control aspects by themselves.

Search terms: Driver performance; Blood alcohol levels; Driving task analysis; Alcohol effects; Alcoholism; Social drinking; Drinking drivers; Hazard perception; Driving simulation; Attention; Driver reaction time; Auditory perception; Visual perception; Driver tests; Loading (operator performance) Laboratory tests; Placebos; Tracking

AVAILABILITY: NTIS

HS-800 682 Fld. 1/1

### EMERGENCY MEDICAL TECHNICIAN INSTRUCTOR TRAINING INSTITUTE. FINAL REPORT

by A. Cleven

Dunlap and Associates, Inc.

1972 183p
Contract DOT-HS-099-1-141

Report for 21 Jun 1971 - 30 Jun 1972.

The purpose of the instructor training institute was to familiarize state and local emergency medical instructional personnel with NHTSA-developed curriculum materials and to enhance their instructional capabilities with this material. A thirty-hour course was designed to correlate with the content of the Emergency Medical Technician-Ambulance course. Trainee comments were used to evaluate the NHTSA procedure for identifying, selecting, and referring state and local personnel to Dunlap and Associates, and to evaluate the content of the instructor training course and its conduct. Sixty-four trainees from 39 states completed the course. A high correlation was found between trainee's evaluations of the institute and characteristics of the trainees as either state or local personnel or as either instructional or other personnel.

Search terms: Curricula; Instruction materials; Instructor training; Program evaluation; Ambulance personnel training

AVAILABILITY: NTIS

HS-800 683 Fld. 2/10; 3/1

### TRAINING MATERIALS FOR TRAFFIC COURT JUDGES. FINAL REPORT

by G. J. Scrimgeour; D. M. Goldenbaum; K. B. Joscelyn

Indiana Univ.

1972 68p
Contract DOT-HS-034-1-207
Report no. DOT-HS-034-1-207-72-2

Report for 1 Jul 1971 - 31 Jan 1972.

This volume concerns development, testing, and evaluation of a training program for traffic court judges in the area of alcohol safety. It describes the activities which led to the production of the training package (consisting of an instructors' manual, judicial manual, administrators' manual, and training aids) for a judicial seminar in alcohol safety. These activities consisted of an identification of the training requirements for traffic court judges at ASAP (Alcohol Safety Action Project) sites; the development of instructional strategies suited to the judges; the development of new materials suitable for use at 35 different ASAP sites; the construction of a training procedure entitled Judicial Seminar in Alcohol Safety; the testing of the procedure at two pilot programs; and the evaluation of the pilot programs.

Search terms: Alcohol Safety Action Projects; Traffic courts; Alcohol education; Instruction materials; Program evaluation; Instruction manuals; Alcohol usage deterrents

AVAILABILITY: NTIS

## NHTSA Imprints

HS-820 177 Fld. 1/3

### ACCIDENT INVESTIGATION AND REPORTING ACTIVITIES OF THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION. ANNUAL REPORT TO THE SECRETARY, DEPARTMENT OF TRANSPORTATION, 1971

National Hwy. Traf. Safety Administration

1972 59p 6refs

The following activities of the Accident Investigation Division are described: field accident studies, new techniques in accident investigation, international activities, and special activities (Federal Go Team). Inter-agency accident investigation coordination with the National Transportation Safety Board, the Bureau of Motor Carrier Safety, and state and local governments is also discussed in detail with accidents of national importance highlighted.

## NHTSA Imprints (Cont'd.)

### HS-820 177 (Cont'd.)

Search terms: Accident investigation; Accident scale drawings; Bilevel accident investigation; Trilevel accident investigation; Multidisciplinary teams; Accident causes; Injury causes; Automobile safety standards; Vehicle kinematics; Impact forces; Blood alcohol levels; Defective vehicles; Accident case reports; Drinking drivers; Failure caused accidents; International factors; Impact tests; Truck accidents; School bus accidents; Accident types; Precrash phase; Crash phase; Postcrash phase

AVAILABILITY: NHTSA

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